**3GPP TSG-RAN WG4 Meeting # 109 R4-2318160**

**Chicago, US, November 13 – 17, 2023**

**Agenda item:** 6.4

**Source:** Moderator (MediaTek inc.)

**Title:** Topic summary for [109][204] LTE\_NBIOT\_eMTC\_NTN\_req

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this summary (e.g. list of treated agenda items).*

This document is the topic summary for RRM requirements for NB-IoT/eMTC core & perf. requirements for NTN, including the following topics covered

* Topic#1: RRM core requirements (AI 6.2.4.1.3)
* Topic#2: RRM perf requirements (AI 6.2.4.1.3)

*List of candidate target of discussions for this topic.*

* 1st round: Proceed Topic 2 perf part first. Decide on the scope, priority, options and tentative agreement to be discussed in the 2nd round.
* 2nd round: Conclude issues with strict consensus.

# Topic #1: RRM core requirements (AI 6.2.4.1.3)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2319350**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319350.zip) | Huawei, HiSilicon | Observation 1: Measurement opportunities for serving cell measurement and neighbour cell measurement shall be shared by different NGSO satellites.Observation 2: For Rel-17 IoT NTN where neighbour cell ephemeris information is not available, UE shall exceed relaxed serving cell measurement before t-Service.Observation 3: When the serving cell and all intra-frequency neighbour cells are in different satellites, UE may have more opportunities for intra-frequency measurement when serving cell measurement is relaxed. However, there is no difference from requirements perspective since the measurement delay are scaled by number of satellites. Observation 4: t-Service is only used to triggering measurement, and the decision on whether to perform cell reselection is still based on measurement results.Observation 5: It is not preferred to make great change on RAN2 procedure on Cell selection/reselection at maintenance stage.Proposal 1In addition to the existing serving cell relaxation conditions, add following conditions for IoT NTN:* The time span to T-service is longer than k, where k = 4 DRX cycle if not configured with eDRX\_IDLE cycle, and k = 1 eDRX cycle if configured with eDRX\_IDLE cycle, when UE already starts measuring intra-frequency neighbour cell measurement in the same satellite.
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| [**R4-2320137**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320137.zip) | Ericsson | 1. In addition to the existing serving cell relaxation conditions, add following conditions for IoT NTN (eMTC and NB-IoT): The time span to T-service is longer than k, where k = 4 DRX cycle if not configured with eDRX\_IDLE cycle, and k = 1 eDRX cycle if configured with eDRX\_IDLE cycle.
* Observation 1: Compared to NR NTN, IoT NTN supports operations with long DRX cycles and eDRX cycles.
* Observation 2: Measurement delays of NB-IoT and eMTC are considerably longer compared to NR NTN measurement delays.
* Observation 3: eDRX cycles of NB-IoT and eMTC can be up to almost 3 hours.
* Observation 4: NB-IoT and eMTC UE can be without any serving cell measurements for almost 11 hours considering:
	+ - longest eDRX cycle of ~ 3 hours,
		- discontinuous coverage of ~8 hours.
1. If the UE is configured with DRX cycle ≥ [1.28] sec, then the UE shall meet the serving cell evaluation requirements defined for DRX cycle of [640] ms starting from at least 2 configured DRX cycles before ‘*t-Service-r17’*.
2. If the UE is configured with ‘*t-Service-r17*’ [2] in the serving cell and eDRX\_IDLE, then the UE shall meet the requirements defined for DRX cycle length of [2.56] s in Table 4.7A.2.1.1-1 starting from at least [2] DRX cycles before ‘*t-Service-r17*’.
3. During discontinuous coverage, the UE shall postpone measurements /radio monitoring until the UE is in in-coverage as defined by the previously acquired SIB32. Upon reaching in-coverage, the UE shall resume the measurements.
 |
| [**R4-2320745**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320745.zip) | Nokia, Nokia Shanghai Bell | [Observation 1: The main reason to execute serving cell measurements is to trigger neighbor cell measurements.](#_Toc149938458)[Observation 2: Measuring the serving cell before t-service might cause unnecessary delay on cell reselection procedure.](#_Toc149938459)[Proposal 1: A UE in relaxation mode, is allowed to skip serving cell measurements after Ttrigger and perform cell selection procedure immediately after t-service is reached.](#_Toc149938460)[Observation 3: The network is capable of controlling the interval between measurements by choosing the (e)-DRX cycle length and the parameter *numDRX-CyclesRelaxed.*](#_Toc149938461)[Observation 4: Introducing a scaling factor for the relaxed cell measurements does not introduce any relaxation factor that can’t be already configured today. Moreover, it introduces additional complications by “unrelaxing” the measurements in certain scenarios.](#_Toc149938462)[Proposal 2: Do not introduce a scaling factor for the relaxation factor for NGSO compared to GSO. The relaxation factor can already be modulated by the RRC parameter *numDRX-cyclesRelaxed* specified by RAN2.](#_Toc149938463)[ Proposal 3: If RAN4 cannot agree to define what “in coverage” means, amend the previous agreement to say that: “in discontinuous coverage scenarios the UE can postpone radio monitoring activities until the UE is in coverage or for a maximum period of [8] hours, whichever comes first”. (Nokia)](#_Toc149938464)[Proposal 3: RAN4 to agree that in discontinuous coverage scenarios, the UE shall perform measurements when the UE is in-coverage which is determined by the information received via SystemInformationBlockType32.](#_Toc149938465) |

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### IDLE state mobility requirements - measurement relaxation

#### Issue 1-1-1: NGSO, serving cell measurement relaxation conditions

**Proposals**

* **Proposal 1**: In addition to the existing serving cell relaxation conditions, add following conditions for IoT NTN (eMTC and NB-IoT):
	+ The time span to T-service is longer than k, where k = 4 DRX cycle if not configured with eDRX\_IDLE cycle, and k = 1 eDRX cycle if configured with eDRX\_IDLE cycle (Huawei, Ericsson)
* **Proposal 2:** no relaxation on serving cell measurement, when UE already starts measuring intra-frequency neighbour cell measurement in the same satellite. (Huawei)

Recommended WF

* In addition to the existing serving cell relaxation conditions, add following conditions for IoT NTN (eMTC and NB-IoT):
	+ The time span to T-service is longer than k, where k = 4 DRX cycle if not configured with eDRX\_IDLE cycle, and k = 1 eDRX cycle if configured with eDRX\_IDLE cycle
* Further discuss the following:
	+ no relaxation on serving cell measurement, when UE already starts measuring intra-frequency neighbour cell measurement in the same satellite

#### Issue 1-1-2: NGSO, skip serving cell measurements after t-service

**Proposals**

* **Proposal 1**: A UE in relaxation mode, is allowed to skip serving cell measurements after Ttrigger and perform cell selection procedure immediately after t-service is reached. (Nokia)
* **Proposal 2:** no new change in maintenance (Huawei)

Recommended WF

* + Suggest no new change in maintenance.

#### Issue 1-1-3: NGSO, serving cell measurement - relaxation factor N

**Proposals**

* **Option 1**: Reuse the legacy mechanism of serving cell measurement relaxation factor N.
	+ **Option 1a**: Do not introduce a scaling factor for the relaxation factor for NGSO compared to GSO. The relaxation factor can already be modulated by the RRC parameter numDRX-cyclesRelaxed specified by RAN2. (Nokia)

Recommended WF

* + Keep existing values if no consensus.

### IDLE state mobility requirements – others

#### Issue 1-2-1: NGSO, serving cell measurement upon t-Service-r17

**Proposals**

* Proposal 1: Do not change DRX requirements based on t-service configuration.
* Proposal 2: (Ericsson)
	+ If the UE is configured with DRX cycle ≥ [1.28] sec, then the UE shall meet the serving cell evaluation requirements defined for DRX cycle of [640] ms starting from at least 2 configured DRX cycles before ‘t-Service-r17’.
	+ If the UE is configured with ‘t-Service-r17’ [2] in the serving cell and eDRX\_IDLE, then the UE shall meet the requirements defined for DRX cycle length of [2.56] s in Table 4.7A.2.1.1-1 starting from at least [2] DRX cycles before ‘t-Service-r17’.

Recommended WF:

* Is the 2nd sub-bullet (eDRX part) in Proposal 2 agreeable?

#### Issue 1-2-2: Discontinuous Coverage upon UE is in coverage

**Background**

Agreements (from RAN4#105)

*When the UE is provided with t-serviceStart-r17 and has discontinuous coverage capabilities, then after t-service-r17 is reached and the UE is out of coverage, the UE may delay or resume cell measurements/search till when the UE is in coverage. Definition of in coverage is FFS*

Excerpt from TS36.304 regarding SIB32

***4 General description of Idle mode***

*If SystemInformationBlockType32 has been received and if the UE has determined that it is out of coverage using available satellite assistance information (e.g. ephemeris parameters and coverage parameters in current or previously received SystemInformationBlockType32, SystemInformationBlockType31, t-Service in SystemInformationBlockType3 or other parameters), the AS configuration (e.g. priorities provided by dedicated signalling and logged measurements) is kept, but the UE need not perform any idle mode tasks. It is up to UE implementation to handle running timers. The detection of out of coverage using satellite assistance information is up to UE implementation and once in coverage the UE shall perform all idle mode tasks.*

**Proposals**

* **Proposal 1a**: During discontinuous coverage, the UE shall postpone measurements /radio monitoring until the UE is in in-coverage as defined by the previously acquired SIB32. Upon reaching in-coverage, the UE shall resume the measurements. (Ericsson)
* Proposal 1b: If RAN4 cannot agree to define what “in coverage” means, amend the previous agreement to say that: “in discontinuous coverage scenarios the UE can postpone radio monitoring activities until the UE is in coverage or for a maximum period of [8] hours, whichever comes first”. (Nokia)
* [**Proposal 1c:** RAN4 to agree that in discontinuous coverage scenarios, the UE shall perform measurements when the UE is in-coverage which is determined by the information received via SystemInformationBlockType32.](#_Toc149938465) (Nokia)
* **Proposal 2:** No further clarification is needed.

Recommended WF

* + RAN4 to agree that in discontinuous coverage scenarios, the UE shall perform measurements when the UE is in-coverage which is determined by the information received via SystemInformationBlockType32.

### Core CRs (NWM flag process)

|  |  |  |
| --- | --- | --- |
| [**R4-2318067**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318067.zip) | CR for UE transmit timing requirements for IoT NTN | MediaTek inc. |
| [**R4-2318068**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318068.zip) | CR for RLM for IoT NTN | MediaTek inc. |
| [**R4-2319351**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319351.zip) | CR on maintenance of NB-IoT for IoT NTN | Huawei, HiSilicon |
| [**R4-2320139**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320139.zip) | Correction to IDLE mode Rel-18 IoT NTN requirements | Ericsson |

# Topic #2: RRM perf requirements (AI 6.2.4.1.3)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2319350**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319350.zip) | Huawei, HiSilicon | **Observation 6: If finer granularity is used for negative PHR values, it means less value can be used for higher PHR will actually bring useful information for NW scheduling.** **Proposal 2: Use the legacy values for the new PHR table, and whether to update the value can be discussed in future release (e.g. with coverage enhancement).** |
| [**R4-2320137**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320137.zip) | Ericsson | * **Observation 5: GEO satellites operate around 36 000 km above the earth while LEO satellites operates around 500 - 1 200 km above the earth.**
1. **For NB-IoT PC3 and PCE5 UE in normal coverage managed by GEO with only 4 reportable values, the PHR reporting values are defined as shown in Table 2.**

**Table 2: Power headroom report mapping for UE category NB1 UEs for a cell (e.g. cell1) served by GEO satellite during random access procedure**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -10 |
| POWER\_HEADROOM\_1 | -10 ≤ PH < -2 |
| POWER\_HEADROOM\_2 | -2 ≤ PH < 6  |
| POWER\_HEADROOM\_3 | PH ≥ 6 |

 1. **For NB-IoT PC3 and PC5 UE in enhanced coverage managed by GEO with only 4 reportable values, the PHR reporting values are defined as shown in Table 3.**

**Table 3 Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR when the enhanced coverage level other than 0 is selected during random access procedure and UE is served by GEO satellite**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -40 |
| POWER\_HEADROOM\_1 | -40 ≤ PH < -30 |
| POWER\_HEADROOM\_2 | -30 ≤ PH < 6  |
| POWER\_HEADROOM\_3 | PH ≥ 6 |

1. **For NB-IoT PC6 UE in normal coverage managed by GEO with only 4 reportable values, the PHR reporting values from normal coverage for PC3 and PC5 are reused.**
2. **For NB-IoT PC6 UE in enhanced coverage managed by GEO with only 4 reportable values, the PHR reporting values are defined as shown in Table 2.**

**Table 4: Power headroom report mapping for UE category NB1 in GSO not supporting enhanced PHR when the enhanced coverage level other than 0 is selected during random access procedure [17] for UE PC6**

|  |  |
| --- | --- |
| **Reported value** | **Measured quantity value (dB)** |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -40 |
| POWER\_HEADROOM\_1 | -40 ≤ PH < -30 |
| POWER\_HEADROOM\_2 | -30 ≤ PH < 0 |
| POWER\_HEADROOM\_3 | PH ≥ 0 |

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## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

#### Issue 2-1: UE location acquisition in RRM test cases.

**Background**

*Agreements in RAN4#108*

*Companies are encouraged to provide contribution for the following proposals:*

* + *Proposal 1: Revisit the UE location information and its format of definition. Move and specify the UE location information need, details and provision method in a common section. Detailed exceptions can be handled in individual test cases.*
	+ *Proposal 2: Revisit UE location information need with GNSS signals. Conclude and state clearly whether GNSS performance is required as part of the test scope.*
	+ *Proposal 3: For the introduction release of NTN (both closed WIs for NR (Rel17) and IoT (Rel-18)), define RRM requirements with provision of UE location and movement relevant information, only through AT commands, similarly as RF.*

**Proposals**

* Proposal 1: As R4-2319834, removal of GNSS emulator. (Rohde & Schwarz)

**Recommended WF**

* Is Proposal 1 (R4-2319834) agreeable, or necessary change is needed?

#### Issue 2-2: PHR reporting for NB-IoT in GEO

**Background**

*Agreements in RAN4#107*

* *Introduce a new PHR reporting table for NB-IoT in GEO and use legacy values in []*
* *Note: whether any revision of values is needed can be discussed in the maintenance stage*

**Proposals**

* Proposal 1: Use the legacy values for the new PHR table, and whether to update the value can be discussed in future release (e.g. with coverage enhancement). (Huawei)
* Proposal 2: Update the PHR reporting values for GEO (Ericsson)
* For NB-IoT PC3 and PCE5 UE in normal coverage managed by GEO with only 4 reportable values, the PHR reporting values are defined as shown in Table 2.

Table 2: Power headroom report mapping for UE category NB1 UEs for a cell (e.g. cell1) served by GEO satellite during random access procedure

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -10 |
| POWER\_HEADROOM\_1 | -10 ≤ PH < -2 |
| POWER\_HEADROOM\_2 | -2 ≤ PH < 6  |
| POWER\_HEADROOM\_3 | PH ≥ 6 |

* For NB-IoT PC3 and PC5 UE in enhanced coverage managed by GEO with only 4 reportable values, the PHR reporting values are defined as shown in Table 3.

Table 3 Power headroom report mapping for UE category NB1 UEs not supporting enhanced PHR when the enhanced coverage level other than 0 is selected during random access procedure and UE is served by GEO satellite

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -40 |
| POWER\_HEADROOM\_1 | -40 ≤ PH < -30 |
| POWER\_HEADROOM\_2 | -30 ≤ PH < 6  |
| POWER\_HEADROOM\_3 | PH ≥ 6 |

* For NB-IoT PC6 UE in normal coverage managed by GEO with only 4 reportable values, the PHR reporting values from normal coverage for PC3 and PC5 are reused.
* For NB-IoT PC6 UE in enhanced coverage managed by GEO with only 4 reportable values, the PHR reporting values are defined as shown in Table 4.

Table 4: Power headroom report mapping for UE category NB1 in GSO not supporting enhanced PHR when the enhanced coverage level other than 0 is selected during random access procedure [17] for UE PC6

|  |  |
| --- | --- |
| Reported value | Measured quantity value (dB) |
| POWER\_HEADROOM\_0 | -54 ≤ PH < -40 |
| POWER\_HEADROOM\_1 | -40 ≤ PH < -30 |
| POWER\_HEADROOM\_2 | -30 ≤ PH < 0 |
| POWER\_HEADROOM\_3 | PH ≥ 0 |

**Recommended WF**

* Further discuss. If still no consensus, it can be discussed in the future release.

### Perf CRs (NWM flag process)

|  |  |  |
| --- | --- | --- |
| [**R4-2319834**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319834.zip) | [LTE\_NBIoT\_eMTC\_NTN\_req-Perf] CR to TS 36.133: Corrections to IoT NTN test cases (Rel 18) | Rohde & Schwarz |
| [**R4-2320138**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320138.zip) | PHR reporting requirements for NB-IoT over NTN | Ericsson |
| [**R4-2320147**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320147.zip) | Correction to IoT NTN eMTC test cases | Ericsson |
| [**R4-2320590**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320590.zip) | CR on test case for Cell re-selection for IoT NTN | MediaTek inc. |
| [**R4-2320591**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320591.zip) | CR on test for Random access, timing and signalling characteristics for LTE NB-IoT/eMTC over NTN | MediaTek inc. |
| [**R4-2320592**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320592.zip) | CR for test case of channel quality reporting accuracy | MediaTek inc. |